

[0001] HIGH SPEED HORIZONTAL STACKER

[0002] CROSS REFERENCE TO RELATED APPLICATION

[0003] This application claims the benefit of U.S. Provisional Application No. 60/429,065, filed November 25, 2002, which is incorporated by reference herein as if fully set forth.

[0004] BACKGROUND

[0005] The present invention is directed to a product stacker, and more particularly to a horizontal stacker that stacks items, such as food products, on edge in an ordered horizontal stack.

[0006] For certain types of food products, it is desirable to horizontally stack or accumulate items. This can be used, for example, in reestablishing a loaf of bread after the individual slices have been processed. It can also be used where the type, number or configuration of the items to be stacked are not easily stackable vertically, or where the height of the stack would be too great for conveying or other handling without falling over, becoming disoriented or otherwise changing from the desired configuration. Items, such as French toast, waffles or other comestible products may also require specialized handling to prevent breakage.

[0007] It would be desirable to provide a fast and cost effective means for packaging such products that is not labor intensive and which will not result in unacceptable damage to the products.

[0008] SUMMARY

[0009] Briefly stated, the invention is directed to a horizontal stacker which includes an input feeder that receives the items to be stacked in a first, generally horizontal orientation, and transitions the items to a generally vertical orientation at an off-loading position. A transitioning conveyor is located at the off-loading position which receives each of the items and holds them in the generally vertical orientation

as it carries the items to an accumulator assembly, where the items are horizontally accumulated or stacked. The accumulator assembly includes a holding ram that is connected to a drive that indexes the holding ram back as the generally vertically oriented items are stacked together to hold the items in the generally vertical orientation as they are stacked. A surface of the accumulator assembly that the items are held on comprises an exit conveyor that extends generally at right angles to the transitioning conveyor. Flights are located on the exit conveyor that maintain an accumulated row of stacked items in alignment. After a row is filled, the exit conveyor indexes forward so that a next horizontal stack can be formed.

[0010] In another aspect of the invention, the transitioning conveyor includes individual item holding flights that hold the individual items in a generally vertical orientation as they are received from the input feeder. The item holding flights also act to prevent the items from falling over as they are accumulated in the accumulator assembly.

[0011] Preferably, multiple row forming lanes for product are provided on the transitioning conveyor, and the accumulator assembly also includes multiple lanes for receiving and stacking multiple horizontal stacks, located parallel to one another, at the same time. The exit conveyor then indexes forward with multiple completed horizontal stacks of items located between a plurality of flights on the exit conveyor.

[0012] In another aspect of the invention, the input feeder transitions items from a horizontal to a vertical orientation at an off-loading position where they are supported by a receiving platform. The items are stabilized in their vertical orientation by a collating pusher which is indexed and translates away as additional items are received from the feeder, creating a horizontal stack of vertically oriented items. When a first predetermined count of items are stacked on the receiving platform, the collating pusher withdraws from the platform and stabilization of the stack is effected by a holding ram. When a second greater predetermined number of items are stacked, the collating pusher is re-inserted behind the last item stacked

and, in cooperation with the holding ram, sweeps the completed stack onto an exit conveyor. Again, multiple lanes are preferably provided to allow simultaneous production of multiple stacks.

[0013] Utilizing a system in accordance with the invention allows over 100 items per minute to be vertically stacked in each lane of the horizontal stacker, which can then be carried off for packaging by the exit conveyor in stacks of a predetermined size, such as 8 to 16 items.

[0014] BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The foregoing summary, as well as the following detailed description of the invention, will be better understood when read in conjunction with the appended drawings. For the purpose of illustrating the invention, there are shown in the drawings embodiments which are presently preferred. It should be understood, however, that the invention is not limited to the precise arrangements and instrumentalities shown. In the drawings:

[0016] Figure 1 is a plan view of a horizontal stacker in accordance with a first preferred embodiment of the present invention.

[0017] Figure 2 is an elevation view of the horizontal stacker of Figure 1.

[0018] Figure 3 is a right side elevational view of a transitioning conveyor surface of the embodiment of Figure 1.

[0019] Figure 4 is a horizontal stacker in accordance with another preferred embodiment of the present invention.

[0020] Figure 5a is an elevation view of the horizontal stacker of Figure 4 shown in a first operating position.

[0021] Figure 5b is an elevation view of the horizontal stacker of Figure 4 shown in a second operating position.

[0022] Figure 5c is an elevation view of the horizontal stacker of Figure 4 shown in a third operating position.

[0023] Figure 5d is an elevation view of the horizontal stacker of Figure 4 shown

in a fourth operating position.

[0024] Figure 5e is an elevation view of the horizontal stacker of Figure 4 shown in a fifth operating position.

[0025] DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

[0026] Certain terminology is used in the following description for convenience only and is not limiting. The words "right," "left," "lower," and "upper" designate directions in the drawings to which reference is made. The words "inwardly" and "outwardly" refer to directions towards and away from, respectively, the geometric center of the stacker in accordance with the present invention, and designated parts thereof. The terminology includes the words noted above as well as derivatives thereof and words of similar import. Additionally, the words "a" and "one" refer to one or more of the referenced item, unless specifically noted.

[0027] Referring now to Figure 1, a horizontal stacker 10 in accordance with a first preferred embodiment of the present invention is shown. The stacker 10 includes an input feeder 12 which receives the items to be stacked 14 from a feed area 16, which can be automatically or manually loaded. The items 14 are accumulated in a staging area 18, and when at least one item is in each row forming lane of the stacker 10 at the loading position, the items 14 are indexed forward so that one item 14 in each lane is moved onto a star wheel 20, as shown in Figures 2 and 3. While six row forming lanes are shown, those skilled in the art will understand from the present disclosure that any number of lanes could be utilized.

[0028] As shown in Figures 2 and 3, a star wheel 20 is provided at each lane of items to be stacked, and upon being loaded, the star wheel 20 rotates 90° so that the items 14 are transitioned from a generally horizontal orientation to a generally vertical orientation at an off-load position. In this preferred embodiment, each lane includes two spaced apart star wheels 20 so that each item 14 is firmly and stably supported by the star wheels 20 in order to ensure proper placement.

[0029] Referring to Figures 1-3, a transitioning conveyor 22 is located at the off-load position to receive the now generally vertically oriented items 14. In the preferred embodiment, the transitioning conveyor 22 has six lanes. However, any number of lanes could be utilized. The conveyor 22 can have a continuous belt type surface or can be made up of a plurality of interconnected segments. Individual item holding flights 24 are located on the conveyor 22 which hold the items from the star wheel 20 in a generally vertical orientation on the transitioning conveyor 22. Alternatively, the surface of the conveyor 22 can be fixed, and only the flights 24 are moved so that the bottom of the items 14 slides along the fixed surface as they are moved forward.

[0030] As shown in Figure 3, the flights 24 include an upright finger portion 25 at each lane location to hold the items 14 upright, as shown in Figure 2. Each flight is connected at an upper pin location 26 with an upper chain drive 28 and at a lower pin location 30 with a lower chain drive 32. The chain drives 28, 32 are advanced at the same speeds so that as the items 14 are delivered to the end of the transitioning conveyor 22, the flights 24 remain vertical as they are moved downwardly and out of the way of the next flight 24 carrying the next item 14 to be stacked. The chain drives 28, 32 are preferably driven by motors that are controlled by a controller so that they are advanced in time with the star wheel 20 discharge.

[0031] Preferably, the flights 24 also include slots 34, as shown in Figure 3 at each star wheel 20 location. This allows the star wheels 20 to rotate through the plane of each flight 24 as they transition the items 14 from the generally horizontal to the generally vertical position. The flights 24 each also include a bottom slot 35 that is slightly larger than the size of the finger 25, so that as the flights move downwardly at the right side of the conveyor 22, as shown in Figure 2, the finger 25 of the previous flight 24 can overlap with the next flight 24 during the vertical movement of the flights 24. This allows the pitch of the flights 24 to be varied to suit

a particular item 14 without any limitations that would otherwise be caused by the height of the finger 25.

[0032] The accumulator assembly 40 located at the end of the transitioning conveyor 22 preferably includes an exit conveyor 42, located at right angles to the transitioning conveyor 22, onto which the items 14 are pushed by the flights 24 on the transitioning conveyor 22. Horizontal row defining flights 44 are located on the exit conveyor 42 to define a plurality of stacking rows equal to and aligned with the lanes from the transitioning conveyor 22.

[0033] As shown in Figures 1 and 2, a holding ram 46 is located over the exit conveyor 42 at each horizontally oriented stacking row location. The holding ram 46 is indexed back by a drive 48, controlled by the controller, as each successive item is delivered from the transitioning conveyor 22. The drive 48 is preferably a stepper motor, but could be any other type of electric, pneumatic or hydraulic actuator that provides the desired motion control. Preferably, a single drive 48 is used to move all of the holding rams 46 at the same time.

[0034] Once a desired number of items 14 have been pushed by the flights 24 of the transitioning conveyor 22 onto the surface of the exit conveyor 42 between the row defining flights 44, the exit conveyor 42 is indexed forward by the number of lanes, such that an empty stacking area is present in the accumulator 40 for each lane to start a new stack. The now horizontally stacked row of items 14 are then carried to a further conveyor or packaging equipment where they are preferably wrapped, bagged or otherwise packaged.

[0035] The horizontal stacker 10 is preferably controlled by the controller which can be programmed to control the timing and advancement of the star wheels 20, the transitioning conveyor 22 and the exit conveyor 42, as well as the movement of the holding rams 46. Motor drives are provided for the conveyors 22, 42 and the star wheels 20, and are connected to the controller. Various types of motors can be utilized as will be known to those of ordinary skill in the art. Additionally, sensors

are preferably provided at or upstream from the star wheels 20 to ensure that each star wheel is filled prior to turning. Additional sensors can be provided to ensure that each horizontal stack of items includes the required number of items 14.

[0036] Referring now to Figures 4 and 5a-5e, a horizontal stacker 110 according to another preferred embodiment of the present invention is shown. The horizontal stacker 110 is similar to the stacker 10 of Figures 1-3, and like elements of the two embodiments are represented by like numerals.

[0037] An input feeder 112 receives slices 14 from a feed area 116 where the slices 14 are manually or automatically distributed into row forming lanes. The input feeder 112 includes star wheels 120 each of which receives a slice 14 from a staging area 118. Suitable sensors 160, preferably photoelectric sensors as shown in Figure 5a, are positioned above each of the star wheels 120 to detect the presence of a slice on a respective one of the star wheels 120. Actuators 162, preferably pneumatic or solenoid actuators are positioned in proximity to each of the star wheels 120, one of each preferably positioned between two plates comprising a respective star wheel 120. When the sensors indicate that each of the star wheels 120 has received a slice, a controller signals a drive motor to rotate the star wheels 120 in unison 90 degrees, standing the slices on edge on a receiving platform 164. If after a predetermined length of time the sensors 160 do not indicate that all of the star wheels 120 have received a slice, the star wheels 120 will be rotated and an alarm will be triggered by the controller indicating an incorrect count of slices. The actuators 162 push the slices 14 out of the star wheels 120 against a collating pusher 166 which stabilizes the slices 14 to prevent the slices 14 from tilting forward. See Figure 5a. The collating pusher 166 is preferably a single integrated unit which spans the width of the receiving platform 164 and services flows of slices 14 exiting from each of the star wheels 120. Alternatively, the collating pusher 166 may include individual arms, each of which independently services a flow of slices exiting a respective star wheel 120.

[0038] After a first predetermined count of slices, preferably 3 to 10 slices in each lane have accumulated as a row on the receiving platform 164, the collating pusher 166 drops below the receiving platform 164 and moves back toward the star wheels 120. A holding ram 146 takes over to support the slices 14. See Figure 5b. Slices 14 continue to be loaded on the receiving platform 164 until a second predetermined count has been reached. At that point, the collating pusher 166 pops up behind the last slice in the stack, as shown in Figure 5c, and the collating pusher 166 and the holding ram 146 move in unison to sweep the completed stack onto an exit conveyor 142. See Figure 5d. The collating pusher 166 then returns to its starting position to receive another slice. See Figure 5e. The first and second count of slices may be determined by using indexing devices (not shown) which calculate the position of the holding ram and the collating pusher and/or by using sensors (not shown) which sense the number of slices present or the position of the ram and pusher. The collating pusher 166 is preferably actuated by an electric drive motor and/or a pneumatic device controlled by a controller, and is moveable in both the X and Z directions for controlled back and forth as well as up and down movement. The collating pusher 166 preferably comes up between two star wheels 120 for each lane.

[0039] The stackers 10,110 in accordance with the invention allow various food items, such as French toast as well as other types of items to be quickly and efficiently stacked in horizontal stacks with the items 14 being generally vertically disposed.

[0040] It will be appreciated by those skilled in the art that changes can be made to the embodiments described above without departing from the broad inventive concept thereof. It is understood, therefore, that the invention is not limited to the particular embodiments disclosed, but is intended to cover modifications within the scope and spirit of the present invention.

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